Golf Course Runoff Low Thanks to

Precision Turf Management

Whether it's watermen in the Chesapeake Bay area or farmers in the Midwest, the question is always the same when talk turns to contamination of waterways by surplus agricultural chemicals: What about the golf courses?

In response, all researchers have been able to do is acknowledge that golf courses do contribute pesticides and nitrogen and phosphorus fertilizers to waterways. But no one has known exactly how much because no one ever measured them.

Until now.

Agricultural Research Service (ARS) agricultural engineer Kevin King is measuring nitrogen and phosphorus losses in runoff from three golf courses—in Duluth, Minnesota; in Austin, Texas; and near Columbus, Ohio. He's also measuring pesticide losses from the Duluth and Columbus courses. King is in the ARS Soil Drainage Research Unit on the Columbus campus of Ohio State University.

ARS chemist Pam Rice monitors pesticides on turfgrass plots at the ARS Soil and Water Management Research Unit in St. Paul, Minnesota, with collaborator Brian Horgan, an extension turfgrass specialist at the University of Minnesota. Rice's work is part of a multistate initiative that involves standardized turf plots in various U.S. regions.

King and Rice—both receiving partial funding from the U.S. Golf Association of Far Hills, New Jersey—are the only two ARS researchers studying golf course runoff. While Rice does studies on plots, King looks at the effects of actual golf courses on the entire watershed they drain into. They are coordinating closely, especially on the Minnesota sites.

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Managed turfgrass, such as this golf course green near Columbus, Ohio, is an integral part of the landscape. There are roughly 16,000 golf courses in the United States.

Striking a Balance

King had a lot of golf courses to choose from, since the golf industry is booming in Ohio—as well as in many other states—at an unprecedented rate. Courses are often intermixed with farms and housing developments in the watersheds King studies. Golf is so popular that sometimes a new course is built right next to an older one.

To maintain golf turf, a relatively large amount of fertilizer is used per acre—much more than on farmland, which covers more acreage.

"But fertilizer use is managed very intensively, because if there's anything a golfer cares passionately about—even more than good turf—it's low membership fees," King says. "Also, golf superintendents apply fertilizers in small doses over many applications, minimizing chances for massive losses if it rains shortly after application.

"They don't have as many operations with their crop as farmers do, like tilling, for example," says King. "And they can drive a fertilizer applicator onto the turf any time they want—as long as it's not game time—unlike farmers, whose crops grow too tall to drive a tractor through.

"Golf superintendents can be out at various times of the year, fine-tuning their fertilizer applications based on turf conditions, without too much guessing.

"In fact, golf courses practiced precision agriculture [applying precise amounts according to plant needs and potential for losses] long before the term was coined by the agricultural industry," King says. "Every blade of golf turf is so important that course managers are willing to spend a lot of time determining just the

right amount of fertilizer needed on each square foot of managed turf. Their desire to balance the demands of members for top-notch playing surfaces with low membership fees results in a minimal loss of nutrients, because there is little excess to wash away."

The phenomenon of golf course proliferation is evident in Delaware County, Ohio, about 20 miles north of Columbus. This is currently one of the fastest growing counties in the country. There, turf could easily surpass corn as an agricultural crop, as has already happened in Maryland because of heavy urbanization.

King has 5 years of data from the Austin golf course, since he worked at Temple, Texas, before transferring to Columbus, and 3 years of data from the Duluth course, where study continues. The Columbus-area course is a public one, spawned by development in a rural setting.

Golf Courses Get Clean Bill of Health

King is using watershed instruments installed as part of a new USDA program to measure environmental benefits of conservation practices on farm and turf fields. Runoff water is sampled for flow rate and volume, along with pesticide, nitrogen, and phosphorus content. The Austin and Duluth golf courses are similarly instrumented.

Recorded losses from the Texas golf course are low—6 pounds per acre of nitrogen and 0.3 pounds per acre of phosphorus over 13 months.

"These are small amounts," King says, "but enough to warrant attention. Since losses can vary from region to region, we need to study more turf systems to see what effects different management practices, soils, and climate can have on the results."

Amounts from the other golf courses are even lower, and the pesticide losses measured in Minnesota and Ohio are very low as well. "Golf courses lose much less than most farmland," King says.

But there's always room for improvement. King, Rice, and other researchers nationwide are looking for the best management techniques to minimize losses of nutrients and pesticides while maximizing turfgrass quality.

"Next year, we'll have about 4 years of baseline data in Duluth, so we can then ask David Kohlbry, the golf superintendent, to try turf-management practices we think will reduce losses even further," King says.

"I'm working with Pam Rice to see whether the runoff processes she's measuring can be used to accurately predict runoff at the whole golf-course and watershed scale," King says. He is refining ARS's comprehensive Soil and Water Assessment Tool (SWAT) computer model to predict runoff from golf courses. SWAT was developed to predict management effects on watersheds' water, sediment, and chemical runoff.

If Rice's data on runoff-related processes can be extrapolated to the golf-course or watershed scale, King would then use the data to make SWAT more accurate in predicting losses from golf courses based on various turf-management options.—By **Don Comis,** ARS.

This research is part of Water Quality and Management, an ARS National Program (#201) described on the World Wide Web at www.nps.ars.usda.gov.

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Agricultural engineer Kevin King examines discharge water from a turfgrass system in central Ohio as part of a research program designed to assess how land uses and management affect water quality.